



If some of the formulas in your workbook display error messages after you change or delete a range name, see "Checking Formulas Before Deleting Range Names" in the "Troubleshooting" section at the end of this chapter.

## MANIPULATING DATA WITH WORKSHEET FUNCTIONS

Worksheet functions handle a broad array of tasks, from simple arithmetic to complex financial calculations and intricate statistical tests. Regardless of its complexity, every function consists of two parts: the function name and its *arguments*—the specific values the function uses to calculate a result. The *syntax* of a function defines what type of arguments it uses: text, numbers, dates, and logical values, for example. In most cases, you can substitute a cell or range address or another formula or function as an argument, as long as the data evaluates to the required data type. Some arguments are required, and others are optional. Arguments always appear to the right of the function name, inside parentheses; Excel uses commas to separate multiple arguments.

The following examples illustrate the syntax of some commonly used functions. Bold type means the argument is required. An ellipsis (...) means that the function accepts an unlimited number of arguments.

```
=TODAY()  
=AVERAGE(number1, number2, ...)  
=IPMT(rate, per, nper, pv, fv, type)
```



**TODAY()** is one of the simplest of all worksheet functions. Whenever you open, save, or otherwise recalculate a worksheet that contains this function, Excel updates the value of the cell that contains this formula to display the current date, as stored in your computer's clock chip. This function is extremely common in formulas that calculate elapsed time, such as the number of days that have passed since you mailed an invoice or received a payment.

**AVERAGE** accepts now up to 255 arguments (but requires only 1) and calculates the arithmetic mean of all values in the list, ignoring text and logical values. Although you can enter constant values in this formula, it's most commonly used to calculate the average of a range of numbers, such as monthly sales or budget results. If you calculate a year's worth of monthly sales totals in cells B20 through M20, for example, **=AVERAGE(B20:M20)** displays the average of the 12 monthly totals.

To calculate the amount of interest you pay each month on a mortgage, use the **IPMT** function. As the syntax description shows, you must supply a minimum of four values as arguments. This function requires (in order) the interest rate per period (**rate**), the specific payment period for which you want to calculate interest (**per**, a number between 1 and **nper**), the number of payment periods (**nper**), and the present value (**pv**, the amount of the loan). The final two arguments—future value (**fv**) and the type of loan (**type**)—are optional. Here, too, you're more likely to include a reference to a cell than the actual number in a formula that uses this function.

## NOTE

Although the Formula bar and Excel's help screens always display function names in capital letters, the names are not case sensitive. Use any combination of capital and lower-case characters; when you enter the formula, Excel converts the function's name to capitals.

## ENTERING ERROR-FREE FORMULAS

For some functions, especially those with only a single argument, the easiest course of action is often to type them into a cell directly, using the mouse to select the cell or range address of any arguments.

When you begin to enter a new function or edit an existing one, Excel displays a ScreenTip just below the Formula bar. This yellow box displays all required arguments in bold type, with optional arguments in lighter type. After you enter an argument, the argument name serves as a link—click it to select the entire argument.

For functions with multiple arguments, however, especially those where you're not certain of the exact syntax, a fill-in-the-blanks form often ensures the proper results. The Insert Function dialog box allows you to enter any function and all its arguments quickly and accurately, by using a series of dialog boxes. The Insert Function dialog box is an expert Excel user's best friend: It makes errors nearly impossible, it provides constant feedback as you build a formula, and it includes hooks to surprisingly advanced help, including useful examples of some complex formulas.

## NOTE

Excel 2000 included two tools for automatically inserting functions—the Formula Palette and the Paste Function dialog box. Although their workings are generally similar, these two functions have been combined and extensively redesigned to create the Insert Function dialog box, which was introduced in Excel 2002 and continued to be used in Excel 2007.

You can use the Insert Function dialog box to build a function from scratch: You choose a function from a categorized list and then fill in the arguments using input boxes. Or you can enter part or all of the function and its arguments and use the Insert Function dialog box to edit specific arguments or debug a formula that isn't working as you expect.

To build a function from scratch, follow these steps:

1. Click to select the cell in which you want to add a formula, and then click the Insert Function button (the **fx** just to the left of the Formula bar or the Insert Function on the Formulas ribbon). Excel inserts an equal sign in the Formula bar, positions the insertion point to its right, and opens the Insert Function dialog box.

## NOTE

When you type an equal sign in a cell or the Formula bar, Excel replaces the Name box (just to the left of the Formula bar) with the Function box. When you first use Excel, this list includes the 10 most popular functions; as you use the Insert Function dialog box, Excel replaces the entries on this list with the 10 functions you've used most recently. The last function you used is always the top selection in the Function box.

2. If the name of the function you want to use appears in the Select a Function box, click to select it. If the function you want to use is not on the Most Recently Used list, choose a category. If you're not certain of the exact name of the function, enter a brief description or keyword in the Search for a Function box and click the Go button (see Figure 20.7).

3. The text at the bottom of the Insert Function dialog box offers a brief explanation of the selected function and its syntax (click the Help on This Function link for a more detailed explanation). When you've selected the correct function, click OK. Excel adds the function to the Formula bar and opens a new dialog box with separate input boxes for each argument, as shown in Figure 20.8.

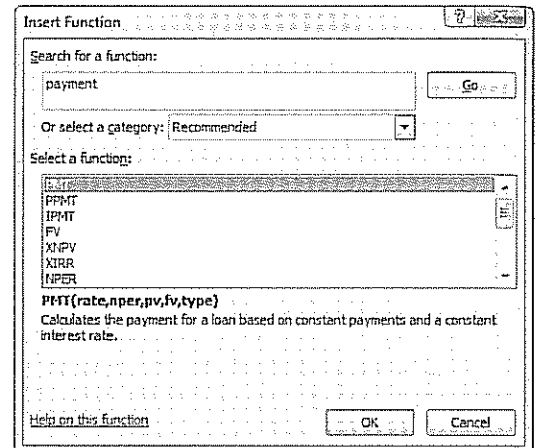


Figure 20.7

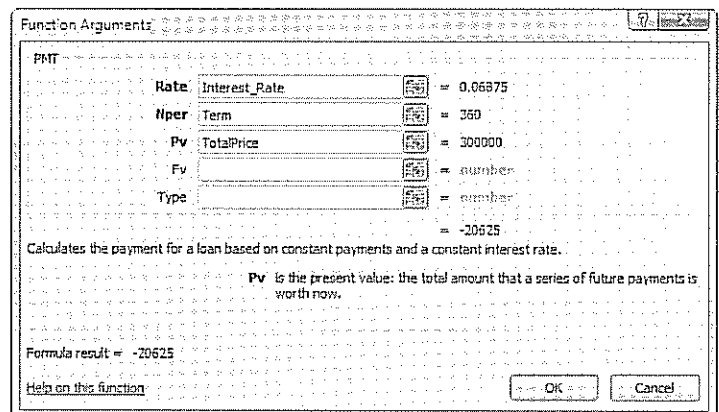
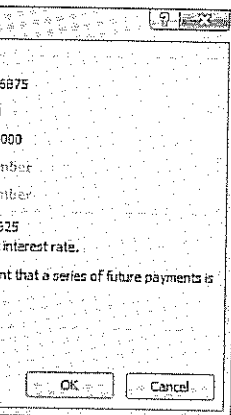
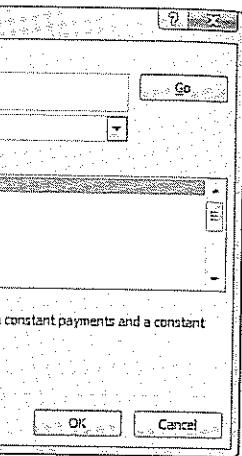


Figure 20.8

4. Click within the first argument box and fill in the required data. Note that the help text at the bottom of the dialog box is specific to the argument you're currently working with, and the data type required for each argument appears to the right of the input box.

- Type text, numbers, and other constants directly into the input box.
- To add cell references by pointing and clicking, first click the Collapse Dialog button (at the right side of each argument input box) to roll most of the Insert

replaces the Name box. When you first use Excel, this is the Function dialog box, the one used most recently. The Name box.



box is specific to the function for each argument in the dialog box.

Collapse Dialog button to the right of the Insert

Function dialog box up and out of the way. Next, select the cell or range to use for the selected argument, and then click the Collapse Dialog button again to continue.

- To use a function as an argument within another function, click to position the insertion point within the box for that argument and then select the function from the Function box to the left of the Formula bar. (See "Using Functions Within Functions" in the next section for more details.)
  - When entering constant values, you can include the percent operator (%) and minus signs (-) with numeric data. Look to the right of the input box to see the current value of each argument you enter. If the data is not of the type required by the argument, Excel displays the word *Invalid* to the right of the input box.
5. Repeat step 4 for other required and optional arguments. Look to the right of the equal sign for each argument to see its current value, using the data you've entered so far. To see the result of the formula itself, look at the text along the bottom of the dialog box.
  6. After entering all required arguments, click OK to paste the complete function into the current cell, or click Cancel to start over.

#### TIP FROM

*EQ: Woody*

*Debugging a formula can be frustrating, especially when you're working with complex formulas containing several nested functions. Here's a backup strategy that allows you to freely experiment with formulas and functions without fear of losing your work or damaging a worksheet. Before editing a formula, remove the equal sign from the beginning of the formula and press Enter; then copy the formula to another cell. Without the equal sign, Excel treats the cell's contents as plain text and copies the formula exactly as it appears, with no adjustments. If your experiments are unsuccessful, copy the backed-up formula to the original cell and then restore the equal sign.*

To use the Insert Function dialog box as a proofreading and reference tool, begin constructing your formula as usual, starting with an equal sign and the function name. After entering the first parenthesis, click the Insert Function button to open the Insert Function dialog box with the current function selected. Any arguments you've already entered will be in the dialog box as soon as it opens.

### USING FUNCTIONS WITHIN FUNCTIONS

In some cases, it's necessary to use one function as the argument for another. *Nesting* functions within functions this way is common with logical functions such as IF, for example. In a sales worksheet that you use to calculate commissions at a regular rate of 5%, you might want to pass along an extra 2% bonus to salespeople who beat their quota in every quarter, and you want to pay no commission to those who fell short of their target number for the year. If the quarterly quota for the first salesperson is in cell B3 and the actual sales for each quarter are in B4:B7, enter the following formula to perform the full calculation in a single step:

```
=IF(MIN(B4:B7)>B3,SUM(B4:B7)*7%,IF(AVERAGE(B4:B7)<B3,0,SUM(B4:B7)*5%))
```

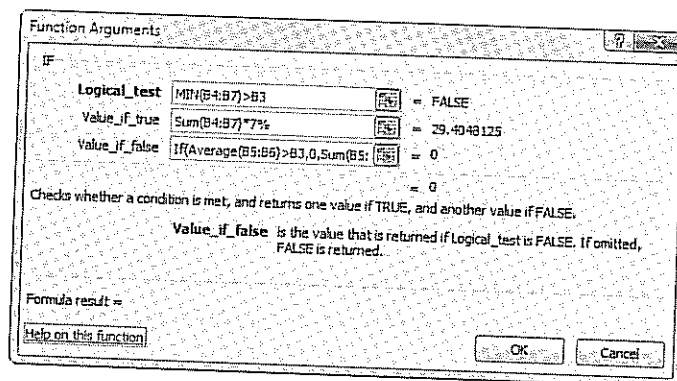
Note that this example includes three levels of nesting, with the final SUM and AVERAGE functions nested within an IF function, which in turn is the final argument of the first IF function. The MIN and SUM functions compose the first two arguments within the first IF effects. Suppose you want to add a date stamp to a worksheet so that whenever you print the worksheet, you'll see a large text label that includes your name and the current date. Enter this formula in a cell that is within the print range, substituting your name in the text string that begins the formula:

```
= "Prepared by John Q. Smith, "&TEXT(TODAY(),"mmm d, yyyy")
```

When you're nesting functions, note that the nested function must return the same value type (text, number, date, true/false) as the argument it's replacing. Unlike formulas containing constants or cell references, which can contain an unlimited number of nesting levels, Excel enables you to nest a maximum of 64 levels of functions. If you need to perform more calculations than this, you'll have to break the formula into multiple steps and place each step in its own cell.

You can use the Insert Function dialog box to enter a nested function within another function. Begin entering the first function by using the Insert Function dialog box, as described earlier in this chapter. Click in the input box for any argument, and then choose another function from the Function box (this box is located to the left of the Formula bar, where the Name box normally appears; it is visible only when the Function Arguments dialog box is open). As you enter the formula, you can switch between functions at any time by clicking the function's name in the Formula bar. If you choose a function that contains a nested function as an argument (as in the example shown in Figure 20.9), the entire function appears in the input box, and the result of the function using current values appears to its right.

**Figure 20.9**  
You can view nested functions within the Formula Bar's Function Arguments dialog box.



## FINDING THE RIGHT FUNCTION

Excel has more than 300 functions, including those available in various add-ins. The following sections list some of the tasks you can accomplish by using functions in each category.